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HOW SHOULD SECONDARY MATHEMATICS FOR GIRLS DIFFER FROM THAT FOR BOYS?

By Mary Adelle Evans.

This question implies that girls should be taught a mathematics different from that given to boys. It is fair to assume that the discrimination is made not on account of sex but on account of dissimilar vocations.

What is secondary mathematics for boys? Its widest scope includes business arithmetic; algebra through quadratics, the progressions, permutations and combinations and the other topics of advanced algebra; plane and solid geometry, trigonometry, an introduction to the calculus, and mechanics. This is a formidable list both for the average boy and for the average girl.

But a certain standardization of secondary mathematics has been brought about by the entrance requirements of the various colleges and technical schools, and by the College Entrance Board. All will agree that secondary mathematics in its limited scope includes algebra, through quadratics and the progressions, and plane geometry.

We will admit at once that for boys and girls preparing for college, technical schools or normal schools, the only difference in secondary mathematics would be occasioned by special requirements of individual higher institutions.

Our first-class high schools today offer college preparatory courses, general courses, business courses, courses preparing for normal schools, and, in some instances, vocational courses. It is already evident that with the college and normal preparatory courses this paper has nothing to do. With regard to the business course, the case is the same. Students taking a regular four year business course should not be differentiated with regard to sex in any subject. The course is not designed for developing girls as girls and boys as boys, but it aims to turn out expert specialists—stenographers, typewriters bookkeepers, etc.

Here girls are competing on the same ground as boys: their equipment must be equal.

Then, where the difference in secondary mathematics for girls and boys *may* occur, is in the general course which is not to be followed by further schooling, and in the vocational course. And this difference should be determined largely by the individual necessities and capabilities of each student.

This is only possible where there is elasticity in the curriculum and where, consequently, the course may be adjusted to the pupil, rather than an attempt made to mould the pupil to the course. In a high school where promotion is made by subject and consequently where "points" or "counts" total up for graduation, provision can be made for the incompetent in mathematics as well as for those specially adapted for its study.

In lines of education where we are not bound by restrictions and requirements of higher institutions, we may differentiate secondary mathematics to the probable advantage of the student.

We are trying to give to the boys and girls of today a broad education, that they may have some idea of life and the world *as it is* before they go out into it. We are trying to make the transition from the classroom to practical life as easy and natural as possible. It is helpful to get the viewpoint of parents on this phase of the educational question. We teachers are tempted to overvalue the importance of our own particular line of work. We are so engrossed in our own subject, it is so large a part of our waking day, that we need constantly to be on guard not to lose the perspective of daily life as it really is, outside of the ideal life of the classroom.

One father, in discussing with me secondary mathematics for boys, said: "In the first year give them practical arithmetic and *hit the high places!* Give them essential facts—not details about the important business questions. This will give to the largest number valuable information which will be immediately available if they must leave school at the end of the year to go to work."

"But where would you teach detailed business arithmetic?"

"In the second year, and more intensive work along the same line each year thereafter," he replied.

"How about algebra and geometry?"

"Make them take it."

"Regardless of course?"

"Yes: there is no business into which a high school boy may enter that will not be the better attended to by one who has had the mental discipline and training in logic and discrimination provided by the study of algebra and geometry."

"And what do you advise for girls?" I asked. His attitude was not so well defined. He advocated training in business arithmetic: for the rest—"Let those girls who wish it, study the higher mathematics."

This leads us to the two values of mathematics—the practical and the cultural. Also, there arises the question of elective courses in mathematics for girls.

Formerly no line of work requiring anything beyond very elementary mathematics was open to women. But now that women compete with men on their own ground, none will deny to the woman engineer, architect, physicist or astronomer as thorough a mathematical equipment as that demanded of the man. Consequently, this leads to the question of training in secondary mathematics for such a woman. The answer is easily found. The high school should provide for the girl the same mathematics as that given to the boy who elects such a course.

Objection will be made that a demand for such work will come rarely in a high school for girls and because of this the school should not be under obligations to provide such a course. But the present indications are that women will need more mathematics as time goes on and as larger opportunities open up to them. Far-seeing parents and ambitious pupils have a right to demand that the public school shall meet this need.

No one should understand me as advocating a *required* course for girls in such rigorous mathematical training, but I wish to go on record as advocating that an adequate course be *elective.*

In our modern "point" or "count" system a good student may find time to specialize and groups of girls frequently ask for solid geometry and some even ask for trigonometry. Provision should be made for classes in these subjects provided a minimum of, say, seven students are registered for a course. This was a regular provision in a small co-educational high school in Pennsylvania, and it is worthy of comment, that *of* *those electing the advanced mathematics* from *twenty* to *thirty per cent.* were girls, who were actuated by love of the subject and ambition to teach it.

Now, if we have inferred that mathematics taught to girls should be different from that taught to boys, how are we to bring them to the point where taste is developed for solid geometry and trigonometry?

The enthusiastic teacher, the diplomatic teacher, the skillful teacher, can whet curiosity in any class, and each class may yield one or more girls eager to try a more advanced course in mathematics. With an elastic system of studies such as I mentioned earlier it would be possible to try out these girls, and in this way find groups of girls adapted to the higher work. Perhaps the teaching of the history of mathematics (girls generally like history even if they do not like mathematics) would arouse in our pupils more of an interest in the subject. We might succeed where now we fail if we could excite an interest in the development of an ancient, honorable, and perfect science and show that, if to be educated means "to know everything about something, and something about everything," neglect of the study of geometry and algebra would make one fall short of this standard.

Now, our American life is first of all practical; and then, if there is time, for the individual it may become cultural. But, despite our private opinions of what life ought to be, as educators we must prepare our pupils for life as it is. And that means that practical business arithmetic should be taught in the high school to every student for *economic protection* and to reach the largest number who can appreciate it.

Every woman should know how to keep a personal account, household accounts, how to make and receipt a bill, how to run a bank account, the meaning and use of a promissory note, the meaning of a mortgage, the advantages of savings banks, building and loan associations, various kinds of insurance, such as health, accident, life, fire burglary, etc. She should understand how to approximate foreign money equivalents, and how to calculate interest so that she may be able to approximate taxes and penalties, incomes, and interests falling due. She should know enough about stocks and bonds to read the newspaper quotations intelligently. Work in fractions of denominators lying between

2 and 16, and in three place decimals would complete an equipment for self-protection. I find that even the slowest, least interested pupil will rouse to a consideration of arithmetical questions which can be shown to be directly related to her own life and her own economic protection.

This outline of subjects would also be the minimum requirement for boys; but the difference in this branch of secondary mathematics for girls lies in the fact that this is a necessary and *sufficient* amount of arithmetic, while for boys the work should be extended as their lives will bring them more directly into touch with business. The average girl will never have use for more arithmetical drill than I have mentioned. But this much she should have in order to be able to protect her own interests, administer her own affairs, and later, probably, administer those of a home.

Just when this course in arithmetic should be given seems open for debate. If given in the first year, it reaches the greatest number of pupils but they are usually too young to appreciate the significance and value of the training. To get the best results as far as experience and ability to appreciate are concerned, would mean to give this course to the relatively few students of the fourth year. Perhaps the wisest time is the second year when the number of students is still large and where the added year of school life and perhaps a little more worldly experience will enable them to appreciate more nearly the subject matter presented. It would be advisable to have, if possible, a short review of the most important features of this course in arithmetic in the last year of the high school course.

Algebra is usually taught in the first year of high school work, and rightly so, if we are to give our girl an opportunity of finding out whether she wishes to specialize in mathematics. Here, too, the teacher can usually tell whether the student is adapted to higher work or whether, being incapable, it would be wiser for her to devote her time to something in which she can accomplish results worth while.

In its problems and applications, algebra for girls should as far as possible touch upon subject matter of special interest to them. Algebra for boys would differ only in its illustrations and applications. It is objected by some that where girls are given only one year of algebra and then take up a business or vocational course, they get so little that they can use, that they speedily forget all about it. The defense offered is that the student must necessarily profit by a year spent in orderly and thoughtful effort, and that the attempt to generalize in accordance with certain laws is of value.

After all, the best that we can hope for from any mathematics taught to those who do not expect to specialize in it, is that the student has learned to think clearly and logically, to discriminate, to weigh, to judge, and has formed an orderly habit of mind.

Statistical graphs may be taught in connection with algebra or with arithmetic. In either case a certain amount of geometric construction would be involved. The point is that these graphs *should be taught.* Newspapers, magazines, reports, etc., are full of this kind of illustration. In this the difference between the work given to boys and to girls would be merely in the subject matter to be graphed. Methods of work would be the same. Choice of material would determine interest in the subject.

And what of vocational mathmatics? Evidently this should be closely correlated with the technical work—cooking, dressmaking, design, etc. The handling of formulas and percentages needs to be taught. The use of the algebraic equation would enter here. Solutions of simultaneous equations of the first degree in two unknowns and with decimal coefficients would occur in the study of dietetics. Certain geometric concepts enter into draughting patterns and making working plans. Here, too, those taking the home economics course may be taught the reading of meters for water, gas, electricity, and the means for determining the amount of radiating surface necessary to heat a room of given dimensions.

The arithmetic in this course would include problems based upon household equipment and administration. In this course, as well as in connection with the algebra taught to girls who are electing a commercial course, simple constructive geometry gives training to the hand and eye, teaches precision and accuracy.

In conclusion let me emphasize the following points:

1. There should be available for girls, *as an elective,* a strong course in mathematics.

2. Every girl should have an appreciative knowledge of the

essentials of business arithmetic in order to administer her own affairs.

3. A knowledge of statistical graphs is necessary to the intelligent reading of newspapers, magazines, etc.

4. Vocational mathematics should include the elements of algebra, geometry and arithmetic.

5. The difference in secondary mathematics for girls from that for boys lies in its applications and is determined by their capabilities and opportunities and not by their sex.

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